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ABSTRACT

This study was designed to examine the nature of nonverbal social interaction between mothers and infants and to compare various situational effects. A total of ten 3-month-old twin infants (five male and five female) and their mothers were videotaped in their homes during free play, bottle feeding and spoon feeding situations. A repeated measures design was employed, accumulating 48 sessions of each activity. Analyses of correlation matrices between total gazing time, gazing frequency, and total session time indicated that play produced a stronger relationship among the variables than the task-oriented feeding activities, with mother total looking time correlated with infant avoidance. The data provide strong evidence that situation variables have a significant influence on social gazing during mother-infant interaction. (Author/JMB)

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EFFECTS OF DIFFERENT SITUATIONS ON MOTHER-INFANT GAZING

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Correlation matrices between total gazing time, gazing frequency, and total session time for gazing behavior of 10 three-month-old twin infants (five male and five female) and their mothers during play, bottle feeding and spoon feeding activities were analyzed. A repeated measures design was employed accumulating 48 sessions of each activity. Video-tape equipment was used in the home, data were gathered as naturalistically as possible. Play produces a stronger relationship than the task-oriented feeding activities among the variables, with mother total looking time correlated with infant avoidance. The data illuminate the nature of the social interaction between subjects, and provide strong evidence that situation variables have a significant influence on social gazing during mother-infant interaction.

EFFECTS OF DIFFERENT SITUATIONS ON MOTHER-INFANT GAZING

Within the last decade, gazing has emerged as the most frequently researched modality of non-verbal communication. Much of this research literature has been reviewed by Argyle and Kendon (1967), Duncan (1969), Ellsworth and Ludwig (1972) and Argyle and Cook (1975).

Infant gazing is of particular importance because the infant's visual system is the first social system to mature. A three- to four-month old infant is capable of discriminating not only the direction of his gaze, but the gaze direction of adults in contact with him; and of participating with the adult in making stochastically predictable changes in gaze direction resulting in a gazing dialogue, the mathematical properties of which conform to a Markov process and are precisely similar to those used in adult vocalizing and speech behavior (Jaffe, Stern & Peery, 1973). Because of the importance of social gazing to the infant some measure of gazing is often made by investigators studying infants' social interaction. Unfortunately, there is little uniformity (and therefore little comparability) in the gazing measures employed by different investigators. Gazing frequency (Osofsky & Danziger, 1974), percent of total session time spent gazing and mean and median gaze duration (Peery & Stern, 1975), and mean number of seconds spent gazing (Ban & Lewis, 1974), have all been used.

Previous studies with both adults and infants all share this common weakness: the measures used to analyze the gazing process reveal little or nothing about the social nature of the interaction under investigation.

The majority of the studies of gazing have used mean gaze duration or total gazing time, individually, as the only reported measures. The fact is, mean gaze duration doesn't tell much about what is taking place in any given interaction. The present study demonstrates the power of using correlations between Total Session Time, Total Gazing Time, and Gazing Frequency to illuminate the nature of nonverbal social interaction between subjects and to compare different situations.

METHOD

Gazing behavior of 10 three-month-old twin infants (five male and five female) and their mothers during play (free social interaction with no other motivation than itself); bottle feeding (the epoch when the nipple is in the infants mouth and the sucking activity is continuous); and spoon feeding (the epoch when the main focus of the mother is to feed the infant by means of a spoon, and the feeding activity is continuous) activities were analyzed. Video-tape equipment was used in the home. A repeated measures design was employed. Five sessions of each activity were recorded for eight of the ten mother-infant dyads, four sessions were collected for the other two of the dyads for a total of 48 sessions of each activity (only 45 sessions of spoon feeding were recorded because of the failure of three dyads to spoon feed on a given day); Visits were made weekly during the infants' fourth month of life. An attempt was made to preserve ecological validity by interfering as little as possible with subjects. A timed record was made for each member of the dyad of each gaze at and away from the other's face during each of the activities. As the terms gaze at or look are used they should be understood to mean looking at the face of the partner in the

in the dyad. To distinguish between gazes at and gazes away from with a minimum of awkward phraseology, the terms look and not-look (or away) are used. Two trained observers achieved a 96 percent agreement as to the occurance of a gaze and a 93 percent agreement as to its duration ± .6 seconds. Further details on subjects and data collection have been reported elsewhere (Peery & Stern, 1976).

Definitions

Total Session Time (TST) means the period during which the dyadic interaction occured, and for which data were recorded. The power for determining the length of the ineraction was exclusively the mothers', but their decisions were often influenced by screaming or sleeping infants. Mother Total Looking Time (MTLT) means the amount of looking time occuring during the session for the mother. Mother Total Away Time (MTAT) is the amount of time during the session that the mother is gazing away from the infant's face. Mother Look Number (M#) is the total number of looks during the session produced by the mother (number of looks = number of aways ± 1). Similar abbreviations are used for analogous infant behavior.

One of the reasons for collecting data without experimental constraint is that the natural upper and lower limits for the above mentioned parameters can be obtained for each session. A disadvantage for limiting the duration of any session experimentally is that such limitations may disrupt the relationship that exist between these variables and their frequency of occurence.

RESULTS

Correlations between Total Session Time, Total Gazing Time, and Gazing Frequency

In all, 95,879 seconds of data were analyzed, including 5495 infant gazes and 4955 mother gazes. Each infant and mother pair contributed approximately equally to the data time. Each activity contributed substantially to the total data, with spoon feeding providing less data time than the other two activities. Mothers looked at infants a greater percentage of the total time about 70% (infants looked about 30% of TST), and for longer durations.

Table 1 shows Pearson product-moment correlation matrices for Mother and Infant Total Looking Time, Total Away Time, Total Number of Looks, and Total Session Time for each of the three activities. Scatter plots for a representative sample of these correlations appear in Figure 1. Each mother and infant produced points on the plots that show the same general tendency as the total correlation which sums other mother and infants.

Insert Figure 1 about here

While product-moment correlation is not the only statistic that could be used to describe the data, it does not misrepresent the tendencies of each mother and infant.

Play

Beginning with the matrices for play at the top of Table 1, for the looking matrix, 8 of the 10 correlations listed are significatly different from zero to the .001 level. A two sided critical region was chosen for

these variables because prediction whether the correlations would be positive or negative is difficul' a priori. For the not-looking matrix, seven of the correlations are significantly different from zero.

The highest relation between any two variables, for either condition and for all activities is the .95 correlation between MTLT and TST for play. The correlation between M# and TST is not significatly different from zero. For mother then, what is important for determining the length of the interaction is not how often she looks, but how long.

Just the reverse is true for the infant during play. ITLT correlate .57 with TST and .56 with MTLT, but I# correlates .74 with TST and .72 with MTLT. The correlation between ITLT and M# is not significant. In other words, how much the infant looks is not as important to either the TST or the MTLT, as how often he looks. With not-looking the Infant Total Away Time (ITAT) correlates .82 with TST. This explains part of the third matrix on the top row of Table 1 which shows that ITAT correlates .79 with MTLT. The more the mother looks, the more the infant doesn't and vice versa. Also, the more the infant doesn't look, the longer the session goes and vice versa.

Part of the picture that emerges during play is of a willing mother and a reluctant infant. Longer and fewer looks are produced by mother, (Peery & Stern, 1975) and session length is determined by how long mothers look.[1] By contrast, infant looks are shorter, they stay away longer (Peery & Stern, 1975) and the more the mother looks the more the infant won't during play.

That is not the entire picture, however. There are two seemingly contradictory correlations here. ITLT correlates .56 with MTLT, but ITAT correlates .79 with MTLT. The seeming contradiction can be explained by two separate processes that are observed during the play sessions. The first

process is analogous to what Cohen (1972) has called attention getting stimuli. The infant does not seem ready to look, the mother fixes the infant's face, and goes through her entire playful, attention getting repertoire. But, the more she looks the more the infant avoids, hence the MTLT-ITAT .79 correlation. Occasionally the mother gets what she seeks and the infant looks at her. She then displays attention keeping behavior, smiling, cooing, and caressing. Now the infant seems to be enjoying this face to face contact and stays with the mother, hence the MTLT-ITLT .56 correlation. This kind of attention seeking--attention maintaining behavior is common among all the mothers observed in this study, and it is nice to see it represented by the hard data.

Bottle Feeding

For the bottle feeding matrices only 4 out of 10 correlations are significantly different from zero for looking, and 3 out of 7 for the not-looking matrix. None of the third matrix correlations reach significance.

The most interesting data for bottle feeding is found in the third matrix which displays the correlations between ITLT, ITAT & MTLT, MTAT & ITLT and MTAT & MTLT. One of the constraints put on the interaction by bottle feeding is an absolute time limit. That is to say, the session is over when the bottle is empty (or the baby is asleep) regardless of what has been going on socially during the session in terms of looking. Since the infant sucks at a fairly constant rate, TST is a function of how much milk is in the bottle. The correlations between ITLT and ITAT, and MTLT and MTAT are negative. Though these correlations are not high, it makes sense that the correlation would be in the negative direction.

If there is a limit on TST because of the amount of milk to be consumed, the more an individual spent his time looking, the less time would be available for not-looking and vice versa. Mother is not as likely to seek actively the infant's gaze while he is away from her, as with play, but will more readily accept that the infant is occupied and not available for looking interaction, and mother will turn away also. MTAT-ITAT correlation is .66.

Spoon Feeding

The last row in Table 1 presents the data from spoon feeding. The primary aim of spoon feeding is to empty the bowl of food. The bowl will be emptied with a fixed number of spoonfuls. It is not surprising to find, then, that the M# (one per spoonful) is highly correlated with TST (.86). MTLT is not so highly correlated with TST (.59). I# shows no correlation with MTLT. M# is also not significaly correlated with MTLT.

Once again, the nature of the spoon feeding activity explains these statistics. The infant gets the spoonful of food whether he is looking at the mother or not, and regardless of how often he looks at her, she will be back with more food as soon as the spoon is filled again. The amount of time the mother spends looking at the baby increases during spoon feeding depending on how many additional swipes are necessary to get all the food inside the infant to stay, not upon whether the infant is or is not looking. It would be expected that M# would not be a good predictor of how long the mother will look at the infant, since that is a function of the infant's reluctance to eat. It would be more likely for MTAT to be positively related to M# (which it is, .75) since the total time necessary to fill the spoon from one spoonful to the next is constant.

DISCUSSION

The data from this study present evidence that both mother and infant utilize different strategies for gaze regulation during each of the three activities, and that each is socially responsive to the different situation constraints. We need to broaden our thinking about infants' social capabilities to include the notion that they can be socially responsive when three-months-old. This view of infants is not new but it is still true that we tend to think less of young infants' capabilities than perhaps we should. Data in this study also suggest that we must be careful not to generalize from data gathered in one situation to expectations for a different situation. Data gathered on mother-infant interaction during a feeding situation (eg. Osofsky & Danziger, 1974) may not present an accurate picture of their interaction during another activity. We realize that adults' social interaction is subject to change with different circumstances, it is interesting that infants social interaction may also vary as a function of different circumstances.

By reporting correlations between gazing statistics and session duration for both adults and infants, instead of reporting measures of central tendency or total gazing time only, we have been able to explicate some of the social processes occuring between mother and infant. Free play is the activity which produces the strongest relationships among the variables. Because play, as defined in this study, is social interaction for its own sake, it is interesting that this activity produces the strongest relationships among our measures of social gazing. The picture of a willing mother and a reluctant infant during play, which has been reflected by mean and median gaze duration (see Peery & Stern, 1975) is reinforced by these

data. It is the mothers who are visually captivated by their infants. Increased mother gazing correlates with infant avoidance, and the more infants avoid, the more mothers look, and the longer the session continues. Our mistrust of gazing as an infant attachment behavior expressed previously (Peery & Stern, 1975; 1976) is further confirmed by these findings. It is the mother who seeks contact with the infant, and therefore, who seems most attached. These findings also indicate that during play, the frequency of infant gaze may serve as a releaser or trigger stimulus for Mother Total Looking Time to a greater extent that the total duration of infant looking.

When the focus of the interaction shifts from the individuals' relationship with each other, to accomplishing a particular task (feeding), the number of significant correlations between the gazing indices decreases dramatically. Bottle feeding seems to be a combination of social and task activities. Mother looking is highly correlated with total session time. Infant looking time correlates about the same with mother looking time as it did during play, but the correlation between infant away time and mother looking time is not significant during bottle feeding, as it was during play. This may be due, in part, to a decrease in motor activity which accompanies sucking (Kessen & Leutzendorff, 1963). It may also be that the soothing effects of sucking and feeding decrease arousal levels for the infants, making it less likely for them to seek attenuation of the social contact they experience during bottle feeding, as they do during play. During bottle feeding mother looking time is more highly correlated with infant looking time than with the number of infant looks, as it was during play, and infant mean and median look durations are longer during bottle feeding than during the other two activities (Peery & Stern, 1975).

Breast and bottle feeding are quiescent times when both mother and infant relax and enjoy a quiet moment together. Mothers typically try to calm their infants during bottle feeding. Play activities by contrast seem to be a time of arousal when mothers seek to stimulate their children and to maintain positive excitement (Stern, 1974). Our correlational data lend support to these intuitive impressions.

The goal of spoon feeding is to empty the bowl of food into the infant as effeciently as possible. Spoon feeding is primarily a task oriented, rather than a social activity. Many of the significant correlations during spoon feeding are best interpreted as a function of the task. Number of mother looks --rather than mother total looking time--is highly correlated with total session time because there is usually one look per spoonful, and a fixed number of spoonfuls before the bowl is empty. Infant away time correlates highly with total session time because if the infant has turned his head away from the mother he is more difficult to feed. Infant away is one measure of the infants reluctance to eat, and it is not surprising that it takes longer to feed a recalcitrant, than a willing infant.

It is especially important to be aware of the effect of imposing time limits on the interaction. This is done inadvertently during the feedings because of the quantity of food to be consumed. Such constraints reduce the potency of the relationships between Total Session Time, and the other measures of gazing.

Methodologically the technique of using correlation matrices for Total Gazing Time, Gazing Frequency, and Total Session Time proves to be a powerful tool for demonstrating the influence of situation variables on social gazing interaction, and for illuminating the confounding nature of activity constraints within and across situations. It is an interactional measure of social activity whose application need not be limited to infants.

FOOTNOTES

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1. Correlation statistics themselves can not be interpreted causally. Because of obvious cause-effect relationships among variables, we have infered some causal interactions throughout the paper. Since Total Session Time is a dependant variable, for example, we infer that the .95 MTLT-TST correlation is best interpreted by assuming the mother is causing the TST changes, not the other way around.

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Table Titles

Table 1. Pearson product-moment correlation matrices for the variables listed during play, bottle feeding, and spoon feeding activities.

Play

	ITLT	MTLT	I#	M#
TST	.57	.95	.74	.23
ITLT		.56	.61	.22
MTLT			.72	.60
I#				.59

	ITAT	MTAT	I#	M#
TST	.82	.70	-	-
ITAT		.55	.69	.70
MTAT			.52	.57
I#				-

	ITLT	MTLT
ITAT	.23	.79
MTAT	.38	.63

N = 48

Bottle Feed

	ITLT	MTLT	I#	M#
TST	.47	.74	.44	.53
ITLT		.60	.45	.36
MTLT			.40	.37
I#				-.00

	ITAT	MTAT	I#	M#
TST	.78	.61	-	-
ITAT		.66	.30	.3[illegible]
MTAT			.40	.25
I#				-

	ITLT	MTLT
ITAT	-.18	.39
MTAT	-.13	-.11

N = 48

Spoon Feed

	ITLT	MTLT	I#	M#
TST	.49	.59	.50	.86
ITLT		.42	.54	.36
MTLT			.01	.34
I#				.37

	ITAT	MTAT	I#	M#
TST	.83	.73	-	-
ITAT		.68	.29	.74
MTAT			.59	.75
I#				-

	ITLT	MTLT
ITAT	-.02	.35
MTAT	.22	.02

N = 45

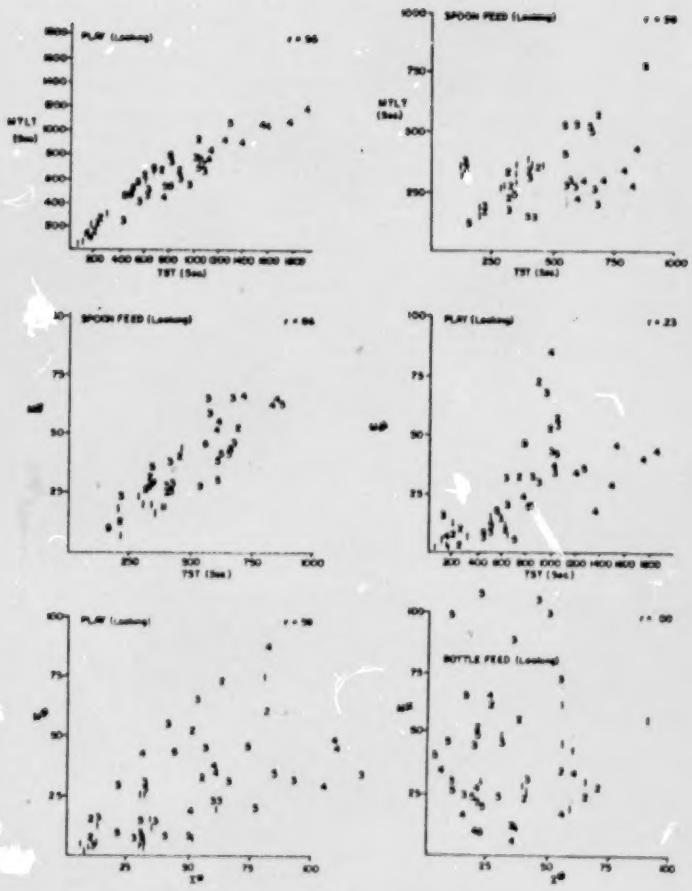
ITLT = Infant Total Looking Time MTLT = Mother Total Looking Time
ITAT = Infant Total Away Time MTAT = Mother Total Away Time
I# = Number of Infant Gazes M# = Number of Mother Gazes
TST = Total Session Time

Note: Two sided critical region for N = 45 is -.46 to +.46 = .001

Figure Caption

Figure 1. A representative sample of the scatter plots for the correlations presented in Table 1.

FIGURE 1


PLAY (Looking)
r = .95
MTLT (Sec)
TST (Sec)
SPOON FEED (Looking)
r = .94
MTLT (Sec)
TST (Sec)
SPOON FEED (Looking)
r = .86
TST (Sec)
PLAY (Looking)
r = .23
TST (Sec)
PLAY (Looking)
r = .58
BOTTLE FEED (Looking)
r = .00